

A new genus and species of Aulonocneminae
from India with notes
on comparative morphology
(Coleoptera: Scarabaeidae)

by

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With 24 figures

ABSTRACT

Palnia loebli gen. nov., sp. nov. is described and compared with *Aulonocnemis crasse-costata* Fairm. Notes on the affinities of Aulonocneminae based on the morphology of related taxa are provided.

Among the material collected in South India by members of the staff of the Muséum d'Histoire naturelle in Genève, I noticed a small member of Scarabaeidae laparosticti placed at my disposal through the kindness of Dr. I. Löbl. The combination of the characters of the mentioned specimen does not correspond well to the traditionally used combination of characters in any of the genera hitherto described, as well as in any of the homogenous groups of species. The examination of particular morphological details of this specimen and direct comparison with the characters of *Aulonocnemis crassecostata* Fairm., argues in favour of its affiliation to the Aulonocneminae. In proposing a new generic and specific name, I take the occasion to provide a short outline of the relationship of Aulonocneminae to other taxa, as visualized on the basis of the comparative morphology including mouth organs.

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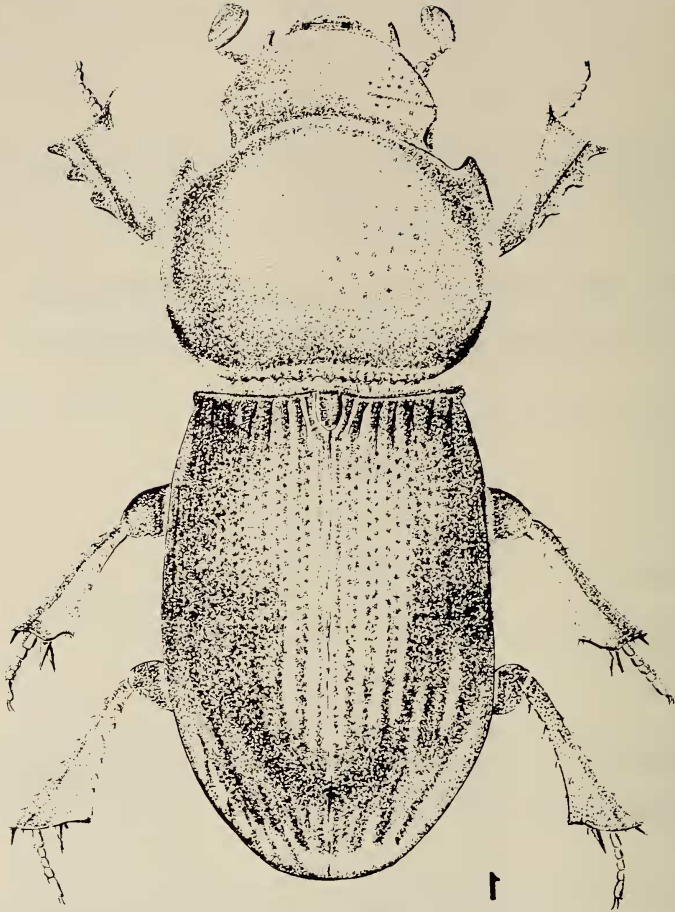


FIG. 1.

Palnia gen. n. *loebli* sp. n., habitus.

Genus **Palnia** nov. (Aulonocneminae)

Generic diagnosis. Head: semicircular, unarmed, clypeus shortened, mandibles and labrum sclerotized, partially visible from directly above; eyes very small, situated latero-ventrally, eye canthus absent; antennae of 9 segments. Prothorax: pronotum subquadrate, anterior median area strongly elevated; proepisterna shallowly excavated anteriorly to receive fore femora. Pterothorax: scutellum small; mesosternum about 3 times as long as wide at widest point; median lobe of metasternum slightly convex, about 2,5 times as long as wide, middle coxal cavities oblique. Elytra: with 8 striae including the one along epipleural edge and 8 intervals including the sutural one, epipleura narrow, humeral tubers absent, elytral suture coalescent. Flight wings vestigial. Legs: fore tarsi present, short, fore spur

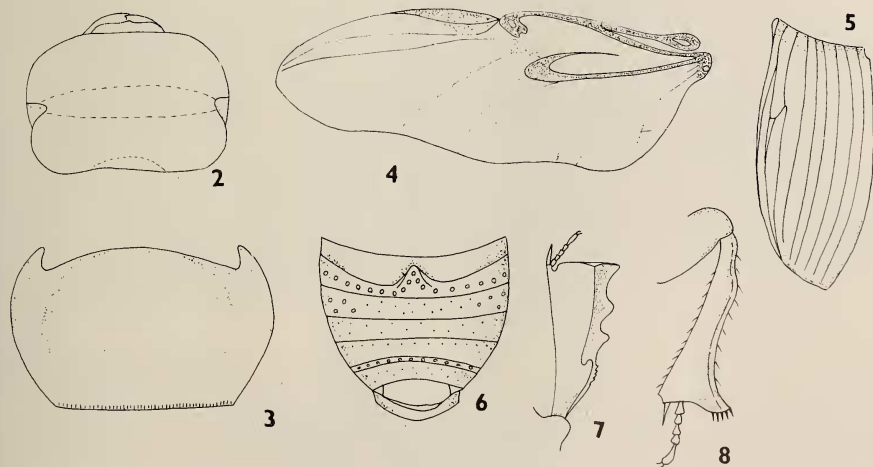
small, outer edge of fore tibia with 3 teeth, the distal edge transversely truncate; middle and hind tibiae strongly expanded apically, flattened without any transverse ridges or denticles, the distal edges on outer side with 2-3 bristles and some thin setae; two short and thin, unequal spurs on middle tibiae, 1 short and thin spur on hind tibiae; middle and hind tarsi short, the joints slightly enlarged apically, claws small. Abdomen: six sternites visible, sternites not fused at middle; pygidium with transverse carina, not exposed; parameres of aedeagus symmetrical.

Type-species: *Palnia loebli* sp. nov.

***Palnia loebli* sp. nov.** (Figs. 1, 13-15)

Type material. Holotype male: India, Madras, Palni Hills, Kodaikanal (2100 m), 11.XI.1972, sieved in forest, C. Besuchet, I. Löbl and R. Mussard (coll. Muséum d'Histoire naturelle, Genève).

Length 3,0 mm, greatest width 1,2 mm. Body oblong, shining, castaneous, antennae yellow. Head twice as wide as long, frontal suture marked on the sides by two darkened spots, surface punctures fine, evenly distributed, separated by their diameters. Pronotum widest at middle, strongly convex in anterior half, anterior angles acute, posterior angles broadly rounded and slightly emarginate, emarginations and base of pronotum with faintly reflexed, crenate and setaceous border; anterior median area finely, sparsely punctate, the punctures toward the sides become larger and closer, separated by their diameters or less, each bearing very minute, erect seta. Scutellum small, rounded apically, impunctate, shining. Elytra subparallel-sided, base margined, epipleura narrow, humeri obtuse; striae near base hollowed, narrower than intervals and here impunctate, on the disc and at apex of elytra shallow, wider than intervals with two rows of punctures contiguous the same size as



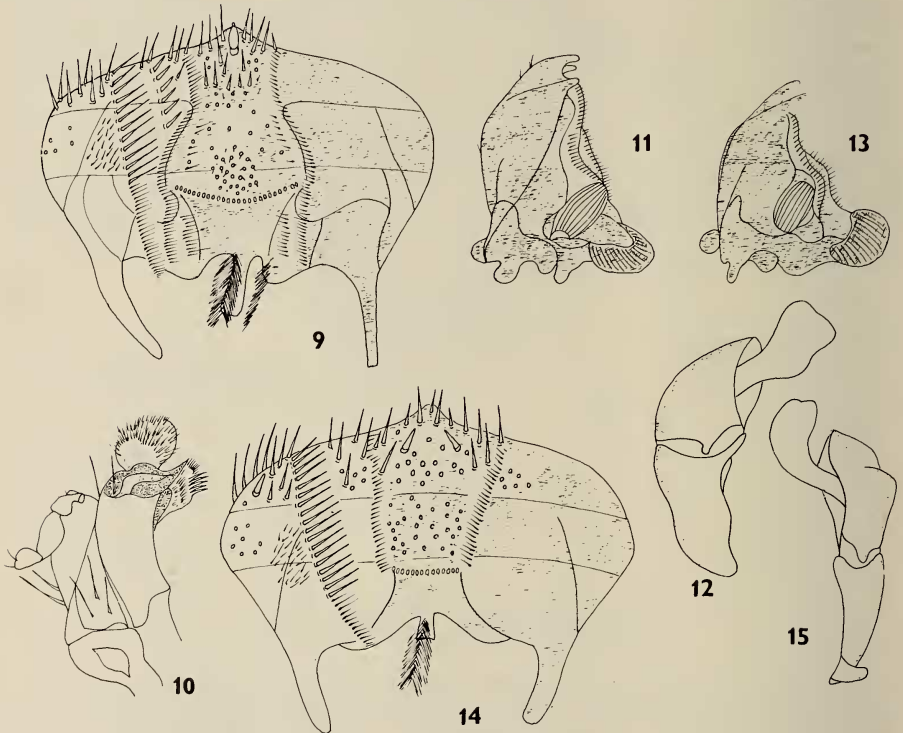
FIGS 2-8.

Aulonocnemis crassecostata Fairm. (Madagascar); 2. Head; 3. Pronotum; 4. Wing; 5. Elytron; 6. Abdomen; 7. Fore leg; 8. Hind leg.

those of pronotum, each bearing very minute erect seta, 7th and 8th striae deeper than the remained; intervals shining, impunctate, subcarinate near base, faintly convex on the disc and at apex, 7-th and 8-th intervals more convex than the remained, 5-th and 7-th intervals united before apex, 8-th and second united at apex. Metasternum convex, midline weak, median lobe nearly impunctate, posterior half coarsely punctate. Abdominal sternites with large shallow punctures. Hind femora narrow, posterior edge margined, surface impunctate; first segment of posterior tarsus a trifle shorter than the next two segments combined. Other characters as given under the generic description. Pronotum, abdomen, legs and maxillae shaped similarly as in *Aulonocnemis crassecostata* Fairm (Figs. 3, 6-8, 10).

R e m a r k s : Although only one specimen was available, a careful partial dissection was thought indispensable for a precise taxonomic evaluation of this remarkable new insect. After having studied the respective elements the specimen has been remounted.

I dedicate this species to my friend Dr. I. Löbl.



FIGS 9-15.

9-12: *Aulonocnemis crassecostata* Fairm.; 9. Epipharynx; 10. Maxilla; 11. Mandibula; 12. Aedeagus laterally.

13-15: *Palnia loebli* nov.; 13. Mandibula; 14. Epipharynx; 15. Aedeagus laterally.

A f f i n i t i e s . The genus *Palnia* may be placed in the Aulonocneminae on account of several of the characters just mentioned, particularly the presence of a single apical spur of hind tibia. The mouthparts visible from above are characteristic for the representatives of Aulonocneminae and of Aegialiini (Aphodiinae), however, the head of *Palnia loebli* is at first glance that of Aegialiini. Prof. R. Paulian, France, and Dr. I. Löbl, Geneva, both examined the specimen and concurred with this placement. Overall structure is essentially matching that of other Aulonocneminae genera, although none of these is closely allied to *Palnia*. Until now the subfamily Aulonocneminae consisted of three genera, the most numerous *Aulonocnemis* Schauf., further *Manjarivolo* R. Paul. and *Ankaratrox* R. Paul. They inhabit Madagascar, South Africa, Comores and Seychelles. I have not seen the representatives of *Manjarivolo* and *Ankaratrox* but their descriptions (PAULIAN 1974; 1976; 1978; PAULIAN & LUMARET 1974) are good enough to state that Aulonocneminae constitute a very heterogenous category, occupying a position close to Coprini on the one hand and to Aegialiini on the other. To stress this fact an attempt is made here to compare one of the best known species, *Aulonocnemis crassecostata* Fairm. as well as *Palnia loebli* with Coprini (including *Dichotomiina* sensu HALFTER & MATTHEWS 1966; MATTHEWS 1976), Aegialiini and other tribes of Aphodiinae presented in order of similarity. The similarities indicate fundamental relationship, although for many of the characters it is not possible to state whether the condition is primitive or derived. A distribution of the basic features of Aulonocneminae, among compared taxa, is presented in the table 1. A differentiation of the mouthparts in relation to the ecological requirements is considered as follows:

I. Mouthparts visible from above.

Mandibles strongly sclerotized, incisor lobe toothed (2-3 teeth), molar area well developed, molar surface often finely grooved; labrum extending outside of clypeus, strongly sclerotized — Aegialiini, Aulonocneminae

- 1) inner side of mandibles with small membraneous plate situated at middle (fig. 17); maxillary lacinia strongly sclerotized, galea with a number of strong bristles (fig. 18); labro-epipharyngeal structures poor (small number of little differentiated sense organs) (fig. 16). Food preference: hard organic substances, e.g. dead wood, leaf litter, mushrooms, spores (new term "hard saprophagy") — Aegialiini
- 2) inner side of mandibles with narrow membraneous plate situated at nearly total length (figs. 11, 13); maxillary lacinia in part sclerotized, setaceous, galea fringed with hairs (fig. 10); labro-epipharyngeal sense organs somewhat differentiated (figs. 9, 14). Food preference: "hard saprophagy" (intermediate form) — *Aulonocnemis crassecostata* Fairm., *Palnia loebli* nov.

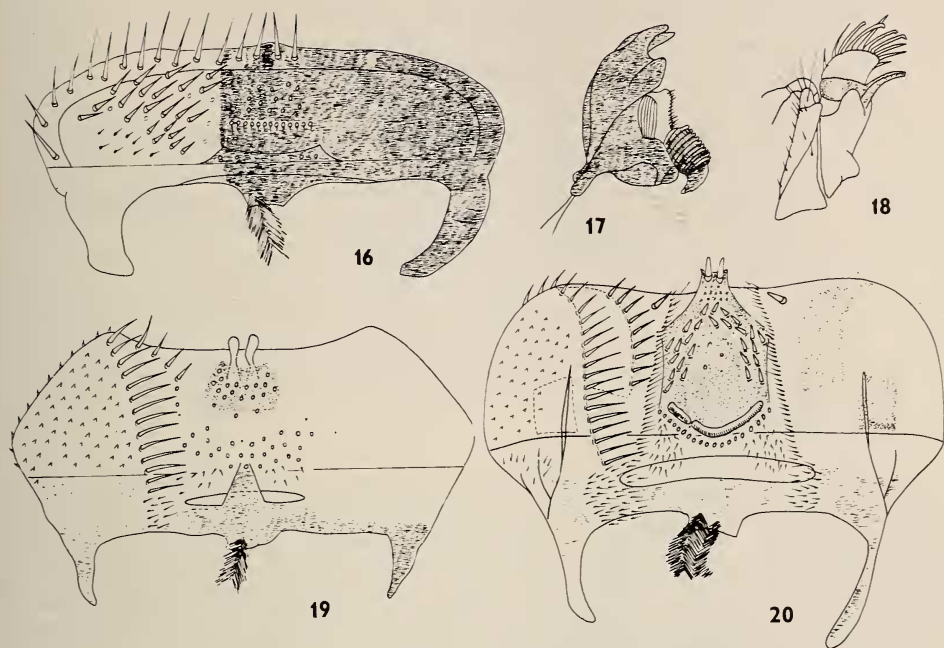
II. Mouthparts invisible from above.

Mandibles partly sclerotized, apical part of incisor lobe and inner side of mandibles membraneous, molar area sclerotized, molar surface usually smooth; labrum hidden; maxillary galea and lacinia covered with short setae or dense pubescence — Coprini/Scarabaeinae, Aphodiinae

- 1) base, molar area and incisor lobe of mandibles sclerotized, incisor lobe apically and inner side membraneous, shortly fringed with hairs; maxillary galea and lacinia submembraneous, setaceous or pubescent, lacinia often slightly sclerotized

TABLE I
Characters of Aulonocnemis crassecostata Fairm. distributed among compared taxa
 Symbols as follows: X – prevailing; \pm – frequent; (\pm) – rare; 0 – not shared

<i>Aulonocnemis crassecostata</i> Fairm.	<i>Pahnia loebli</i> nov.	Coptini		Aphodiinae			
		<i>Coprina</i>	<i>Dichotomina</i>	<i>Aegialini</i>	<i>Euparini</i>	<i>Psammodiini</i>	<i>Aphodiini</i>
1. Body shape elongate	X	0	0	\pm	X	\pm	\pm
2. Head: unarmed, without carinae or/and tubercles (fig. 2)	X	0	\pm	X	X	\pm	\pm
– clypeus shortened, mouthparts exposed	X	0	0	X	0	0	0
– antennae 9 – segmented	X	X	X	X	X	X	X
3. Pronotum: anterior median area strongly elevated (fig. 3)	X	\pm	0	0	(\pm)	0	0
4. Scutellum: very small	X	0	0	(\pm)	\pm	(\pm)	(\pm)
5. Elytra: epipleura narrow	X	\pm	X	(\pm)	(\pm)	(\pm)	(\pm)
– striae 8-th and 9-th irregular (fig. 5)	0	\pm	X	(\pm)	(\pm)	(\pm)	(\pm)
– flight wings well developed, the shape similar as in <i>Aegialini</i> (fig. 4)	0	\pm	\pm	\pm	\pm	\pm	\pm
6. Legs: hind tibiae with one apical spur	X	X	X	0	0	0	0
– middle coxae separated by metasternum	X	X	X	(\pm)	(\pm)	(\pm)	(\pm)
– fore tibiae truncated anteriorly (fig. 7)	X	\pm	\pm	(\pm)	(\pm)	0	(\pm)
– middle and hind tibiae flattened	X	0	\pm	0	(\pm)	0	(\pm)
– middle and hind tibiae without transverse carinae (fig. 8)	X	(\pm)	X	\pm	X	(\pm)	(\pm)
7. Abdomen: 6 sternites visibles (fig. 6)	X	X	X	X	X	X	X
– sternites not fused at middle	X	\pm	\pm	\pm	X	X	X
– pygidium not recurved to conceal part of abdomen	X	\pm	\pm	\pm	X	X	X
– pygidium with transverse carina	X	X	X	\pm	X	(\pm)	0
– paramerae of aedeagus symmetrical (fig. 12)	X	X	\pm	X	X	X	X
8 Habits: bark		0	0	(\pm)	0	0	0
– humus	X?	0	0	X	X	X	(\pm)



FIGS 16-20.

- 16-18: *Aegialia arenaria* (F.) (Poland); 16. Epipharynx; 17. Mandibula; 18. Maxilla.
 19: *Psammodius malkini* Cartw. (Florida); epipharynx.
 20: *Ataenius californicus* Horn (Utah); epipharynx.

- a) labrum membraneous except the sclerits of epitorma, crepis and tormae; some additional, slight sclerits as marked on fig. 20. Type of labrum characteristic of Eupariini
- b) labrum membraneous except the sclerits of epitorma, crepis and tormae (fig. 19). Type of labrum characteristic of Psammodiini.

Food preference: liquid organic contents e.g. vegetal juice, dissolved albuminous substances and/or bacterial albumens in decaying humus (new term "soft saprophagy")

- 2) base, molar area and incisor lobe of mandibles sclerotized in basal two-thirds, apical part and inner side membraneous, fringed with hairs (fig. 21); maxillary galea and lacinia usually membraneous, covered with dense hairs; labrum membraneous except the sclerits of epitorma, crepis and tormae (fig. 22). Type of labrum characteristic of Aphodiini.

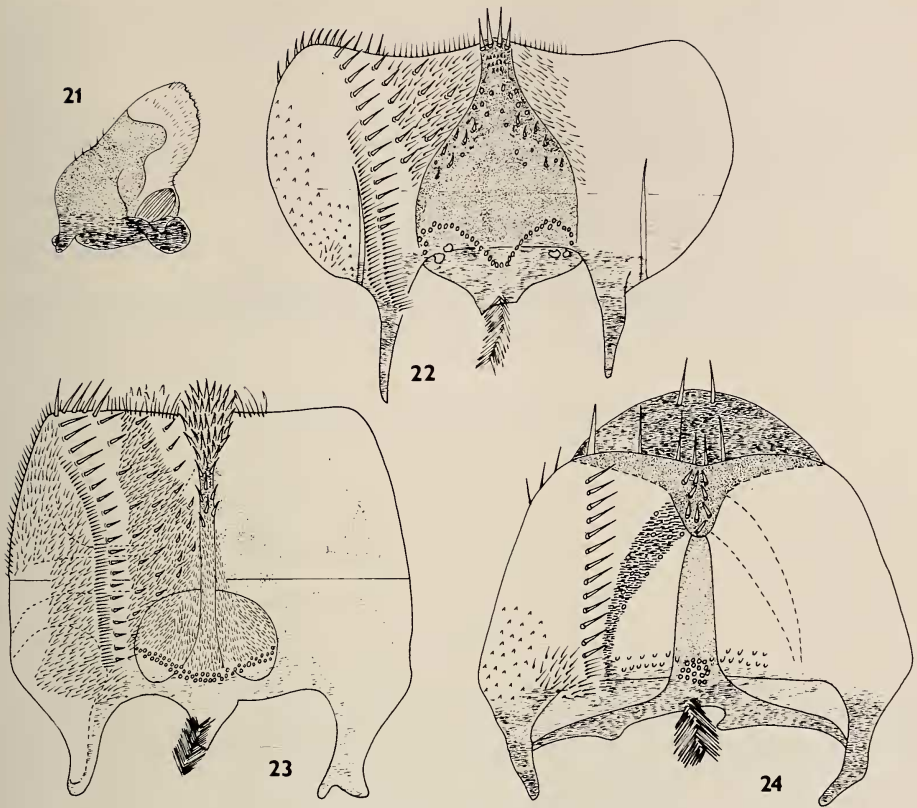
Food preference: liquid contents of specific enzymatic qualifications, e.g. dissolved albuminous substances, bacterial albumens in excrements and/or vegetal juice (coprophagy and retiring "soft saprophagy"). There is a number of intermediate forms.

- 3) molar area and incisor lobe of mandibles strongly sclerotized in basal two-thirds, apical part of incisor lobe membranous, inner side with broad membranous plate densely fringed with hairs; maxillary galea and lacinia membranous, usually densely pubescent or lacinia with a few bristles
 - a) labrum usually twofold, forming a membranous pocket in anterior half of upper side; epitorma, crepis and tormae sclerotized, usually occur the additional slight sclerites marked on fig. 23; labro-epipharyngeal structures rich, the numerous sense organs differentiated. Type of labrum characteristic of Coprini/Scarabaeinae. Food preference: liquid or subliquid contents — general coprophagy, necrophagy, carpophagy, mycetophagy, bacteriophagy
 - b) labrum twofold or onefold, membranous except the sclerites of epitorma, crepis, tormae and a small sclerome at anterior margin as marked in fig. 24; labro-epipharyngeal sense organs less numerous and less differentiated than in other Coprini. One of the intermediate types of labrum observed among the representatives of Dichotomiina.

There are two main types of mouthparts in Scarabaeidae laparosticti, one more generalized and fundamental, and one highly specialized and complicated. The first is present in Aulonocneminae, Aegialiini, Geotrupidae and other small taxonomic units, the second occurs in Scarabaeinae and in the remaining tribes of Aphodiinae excluding Corythoderini. Between and within both types appears a number of intermediate forms departing from the straight saprophagous type, and disclose a successive adaptation to more specialized mode of feeding. The author's current studies on the morphology of mouth organs reveal, that the shape of mandibles and the structures of labrum are much more differentiated within examined genera and tribes than the structures of the remaining mouthparts, and the basic structural changes of these elements are always exactly correlated. The labro-mandibular constructions offer very valuable classificatory characters and are sufficient for deducing a regimen of examined species or groups of species within Scarabaeoidea. On the other hand the ecological factors, in combination with a series of other criteria, may be used in phylogenetic consideration (HOWDEN 1983).

C o n c l u s i o n s . As compared, the basic feature that distinguishes Aulonocneminae from Aphodiinae is the occurrence of a single apical spur of hind tibiae. This diagnostic feature, shared by Coprini and Aulonocneminae is in fact the only one which determines a taxonomic status of Aulonocneminae as isolated group of species, since there are many overlapping characters among various species of confronted taxa. The more or less pronounced separation of middle coxae as well as other characters appear individually in a number of species belonging to the different scarabaeid groups. On the other hand, Aulonocneminae and Aegialiini share such important characters as the shape of flight wings, unless reduced (BALTHASAR 1943; LANDIN 1960), the shape of copulatory organs, the larval morphology (PAULIAN & LUMARET 1974), the general type of mouthparts, the food preferences and habits. The primitive character of ecological environment, of a mode of life and a relict pattern of the distribution of Aulonocneminae and Aegialiini (STEBNICKA 1977) do not in any way contradict a common origin of these apparently very old scarabs.

I prefer not to speculate presently on evolution of various characters until relationships can be specified more precisely and until a reasonably convincing scheme can be proposed for the phylogeny of this complex. On the basis of the facts available I am inclined to consider Aulonocneminae as a hitherto "missing link" between Coprini/Scarabaeinae



FIGS 21-24.

- 21-22: *Aphodius (Agrilinus) monicae* Steb. (Nepal); 21. Mandibula; 22. Epipharynx.
 23: *Oxysternon festivum* L. (Brazil); epipharynx.
 24: *Paraphytus sendyi* Paul. (Côte d'Ivoire); epipharynx.

and their closest relatives Aegialiini/Aphodiinae. This subject is no doubt worth of a closer comparative study based on continued discoveries of new elements uniting split groups by filling up the gaps between them.

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